

# Global Perspective on Kidney Transplantation: Argentina

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## Introduction and Structural Organization of Transplantation in Argentina

Argentina is the eighth largest country in the world (surface area of 2,780,400 km<sup>2</sup>), and the third most populated country in South America (its estimated population is 44,494,502). It is divided into 24 autonomously governed provinces (1). The health care system in Argentina, which covers >22 million people, is decentralized, with multiple state-dependent funders consisting of social security, public, and private subsectors. There are 4.5 hospital beds per 1000 inhabitants and 3.49 physicians per 1000 inhabitants (overall there are 166,187 physicians in the country) (2,3). There is one nephrologist for every 40 patients, ranking third in Latin America in terms of the number of nephrologists per million inhabitants (4,5).

The first kidney transplantation in Argentina was performed in Buenos Aires in 1957 by Lanari *et al.* (6). Over the next several decades, a series of laws were sequentially passed, aiming to streamline the national transplantation processes. These ultimately led to the creation of a single national, decentralized organization called the National Central Institute for the Coordination of Ablation and Implantation (INCUCAI), an entity under the National Ministry of Health. INCUCAI's mission is to promote, regulate, and coordinate activities related to the procurement and transplantation of organs, tissues, and cells at a national level, guaranteeing transparency, equity, and quality (7). In 2003, the INCUCAI created a database system called The National Procurement and Transplantation Information System of the Argentine Republic to track, assess, regulate, and manage all transplant activities in Argentina. It provides free online access to all essential information related to organ transplantation and the registry of patients on dialysis. This system is also used to help guide health policies and clinical research (8).

The country is divided into five procurement regions, encompassing 157 transplantation centers. Of these centers, 61 perform kidney transplants, 35 liver, 16 kidney-pancreas, 28 heart, eight lung, five heart and lung, and four intestinal transplants. Historically, the vast majority of transplant surgeries were performed by a combination of vascular

surgeons and urologists, but recently general surgeons specifically trained in multiorgan transplantation services have joined the services and established laparoscopic living donor nephrectomy techniques. Pre- and post-kidney transplant care is managed by transplant nephrologists as a fundamental part of a multidisciplinary team that also includes psychologists, social workers, specialized nurses, etc. The Argentine Society of Transplantation, which brings together all transplant professionals, was established in 1982 (3,4). Argentina supports the Declaration of Istanbul and participates actively through its scientific societies in the summit of the Pontifical Academy of Sciences to combat organ trafficking and transplant tourism (3,7).

## Kidney Transplantation in Argentina

The characteristics of the kidney transplant population in Argentina are shown in Table 1. There have been 15,774 kidney transplants performed in Argentina since 1998 (1). Of these, 89% were performed in adult patients and 11% in pediatric ones. The majority of transplants originate from deceased donors with the predominant cause of death being stroke (52%) and traumatic brain injury (39%) (1,8). In 2005, a major initiative was made to increase organ donation by the passing of the Law of Presumed Consent. However, although this law established that all persons should be considered potential donors, donation still required confirmation from a family member. This law was updated in 2018 that established that all people are potential donors, unless they had previously declared themselves as nondonors to INCUCAI. Although family refusal to donate was already decreasing (from 45% in 2016 to 33% in 2018), the new law further reduced the rate of refusal to 13% in 2019. These changes have increased the donation rate from 11.8 per million population (PMP) in 2016, to 15.8 PMP in 2018, and 19.9 PMP in 2019. Indeed, barriers to donation are now more logistical in nature (*e.g.*, limitations in the universal harvesting and transportation of organs throughout the country), rather than due to social or cultural grounds.

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**Table 1. Characteristics of kidney transplant recipients in Argentina<sup>a</sup>**

General Characteristics of the Health Care in ESKD and Kidney Transplant in Argentina		
Population	44,938,712	
Population on dialysis (HD+PD)	30,607	
Population of ESKD on the waiting list	5221 (17%)	
Population with a functioning kidney transplant	11,486	
Adult LDKTs (2019)	3998 (92%)	
Pediatric LDKTs (2019)	367 (8%)	
Number of KT centers	61	
Cost of peritransplant module (20 days post-transplantation)	US\$4840 <sup>b</sup>	
Monthly cost of the post-transplantation module (average)	US\$212 <sup>b</sup>	
<b>Comparison DDKT</b>	DDKT	LDKT
Total KT from 1998 to the present	15,740	5069
KT per year (2019)	1232	359
Source: DDKT versus LDKT, %	69	31
Age of the recipient, yr, mean±SD	45.5 (45.2–45.8)	36.3 (35.9–36.7)
Male, %	57%	57%
Cold ischemia time, mean±SD	19.37 (19.2–19.5)	1.5 (1.35–1.62)
Time on dialysis until kidney transplantation, mean±SD	6.1 (5.97–6.22)	1.96 (1.89–2.05)
Years on the waiting list, mean±SD	2.32 (2.35–2.40)	0
<b>Causes of death post-transplant, %</b>	DDKT	LDKT
Infection	43	36
Cardio-cerebrovascular	24	19
Other	15	13
Neoplasm	7	19
<b>Causes of graft loss, %</b>	DDKT	LDKT
Chronic allograft dysfunction	38	48
Others	30	32
Acute rejection	17	15
Primary nonfunction	7	1
Vascular complications	3	2
Urological complications	1	1
Infection	2	0
Noncompliance	1	0
Recurrent disease	1	1

HD, hemodialysis; PD, peritoneal dialysis; KT, kidney transplant; LDKT, living donor kidney transplant; DDKT, deceased donor kidney transplant.

<sup>a</sup>Official data from National Central Institute for the Coordination of Ablation and Implantation between January 1, 1998 and December 31, 2019.

<sup>b</sup>Using the unofficial exchange rate as of August 2021 (approximately 186 Argentine pesos per dollar).

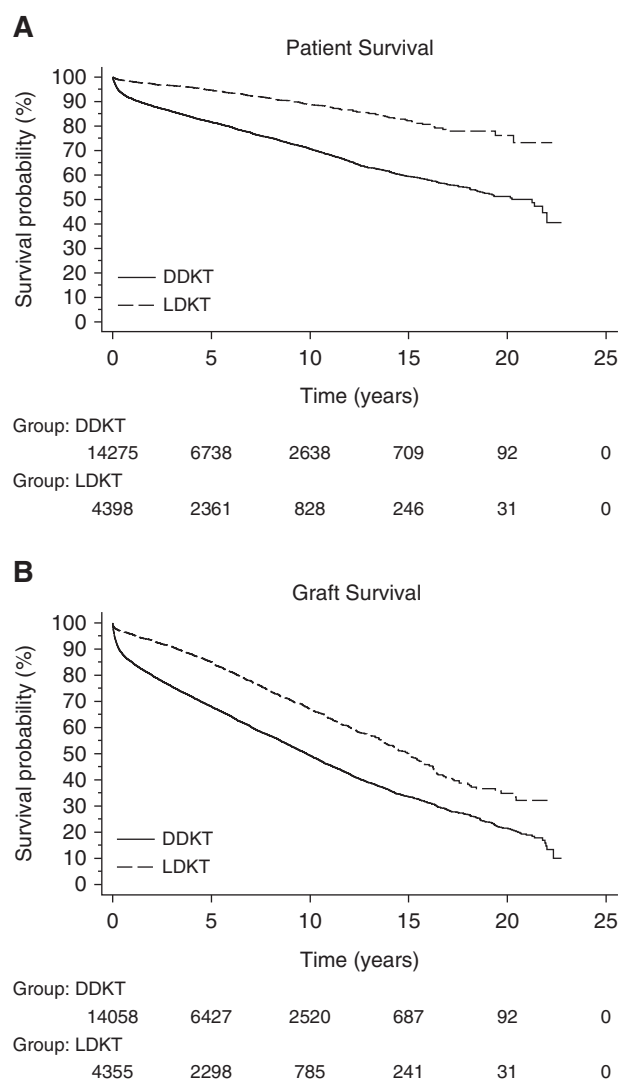
Despite these advances in donation, overall transplantation rates are insufficient to meet demand. The overall ESKD dialysis population in Argentina is 30,607 patients, of whom 5221 (17%) are on the waiting list (2). The average waiting time on the transplant list is >6 years. In 2019, there were 1674 kidney transplants, 69 simultaneous kidney-pancreas, 19 kidney-liver, and five kidney-heart transplants. Of the 1674 kidney transplants, 1325 (79%) were deceased donor kidney transplants (DDKT) and 349 (21%) were living donor kidney transplants (LKD). This percentage of LKD has hovered between 20% and 30% over the last 10 years. In total, 97% of LKDs came from related donors, and 14% were performed preemptively. Although paired donation is allowed in the national exchange program, they are quite rare.

The cost of renal transplantation is predominantly covered by governmental agencies including the National Institute of Social Security for Retirement and Pensions (47%), public insurance (35%), and provincial social security (12%); commercial insurance accounts for the remaining <10%. These insurances cover almost all transplant-

related costs. In general, patients do not incur any out-of-pocket costs for any post-transplant care, other than for a few prophylactic medications. In 2021, the estimated cost for the kidney transplantation module (including kidney transplant surgery and all immunosuppression and general medication during first 20 days) was close to US\$4840 (considering the unofficial exchange rate of approximately 186 Argentine pesos per dollar; however, there is an alternative market with values that differ greatly from the official ones because the Argentine government imposes very high taxes and strict restrictions for the purchase of foreign currency). It was US\$212 per consult for the monthly post-transplantation module (monthly outpatient clinic visit) (4).

### Outcomes and most Common Complications of Kidney Transplantation in Argentina

As expected, adults that receive an LDKT have better patient and graft survival rates than adults receiving DDKT (5,8). Patient survival rates for LDKT versus DDKT



**Figure 1. | Patient and graft survival in deceased donor kidney transplant versus living donor kidney transplant in Argentina from 1998 to 2019.** LDKT, living donor kidney transplant; DDKT, deceased donor kidney transplant.

were 98% versus 90%, 95% versus 80%, and 90% versus 68%, at 1, 5, and 10 years, respectively. However, graft survival rates were 97% versus 83%, 87% versus 66%, and 71% versus 46%, for these same time points (Figure 1, A and B) (5,8). The main causes of graft loss in DDKT were chronic allograft dysfunction (38%) followed by acute rejection (17%), primary nonfunction (7%), infections (2%), vascular complication (3%), urological complication (1%), noncompliance (1%), recurrent disease (1%), and others (30%) (5,8). Of note, in Argentina, infection constitutes a main cause of death in patients with functioning grafts close to 43% for DDKT, similar to that reported by the Latin America Dialysis and Transplant Registry (9).

### Effect of Delayed Graft Function

A major challenge for optimizing transplant outcomes in Argentina, as in most of Latin America, is the high

incidence of delayed graft function (DGF) after DDKT (approximately 60%). The causes of DGF in Argentina are multifactorial, but predominantly related to suboptimal organ maintenance due to prolonged cold ischemia time and limited access to extracorporeal perfusion machines (9,10). Because DGF results increased length of stay, need for dialysis, infection rates, acute rejection (with the associated decrease in graft and patient survival), and costs, it has had an increasingly detrimental effect on the advancement of kidney transplantation in Argentina. Other barriers negatively affecting organ donation in the country include: (1) sociocultural problems related to fear and myths about donation, (2) lack of educational campaigns in schools, (3) lack of early identification of potential donors in the health care facilities, and (4) suboptimal education regarding transplantation to health care personnel (3,9).

### Future Perspectives and New Challenges

The kidney transplant program in Argentina has made much progress since its inception. Some of the major advances include (1) a legal framework and structured governmental organizations that oversee organ donation and transplantation, these have improved access to transplants; (2) the development of a network of highly skilled personnel, which has improved outcomes due to better transplant and post-transplant care; and (3) an online registry system for traceability of donation-transplantation process (5). However, there are still several challenges to overcome. First, we must further educate our health care administrators and funders so they recognize that kidney transplantation is the most cost-effective treatment for advanced CKD, because it not only restores the patient's quality of life, but also significantly improves survival (compared with patients that remain on dialysis), and lowers public health costs. That is, it needs to be recognized as the treatment of choice. Second, we must increase the donor pool by increasing the use of expanded criteria deceased donors and strongly encourage the growth of LDKT programs. Finally, we must improve organ preservation by incorporating the routine use extracorporeal perfusion machines, reduce cold-ischemia times, and develop donor procurement protocols for organ harvesting post-circulatory death. We believe these measures would further improve the national transplant program.

### Disclosures

R.A. Maldonado reports receiving speaker honoraria from Astra-Zeneca, Novartis, and Sandoz; reports being a scientific advisor or member as the Coordinator of Transplant Work Group of the Argentine Society of Nephrology, and Member of Kidney Transplant Committee of Argentine Society of Transplantation; and reports other interests/relationships as President of the Córdoba Society of Nephrology. The remaining author has nothing to disclose.

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#### Author Contributions

R.A. Maldonado wrote the original draft; both authors conceptualized the study, were responsible for the methodology, provided supervision, and reviewed and edited the manuscript.

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